Problem Centered Teaching by Tomorrow

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What is your educational role?

1. Administrator
2. Teacher
3. Curriculum
4. Other

Who We Are:

- The Illinois Mathematics and Science Academy (IMSA) is a 3 year residential High School for academically advanced students in Illinois
- IMSA's *Center for Teaching and Learning* offers programs, content, and professional development opportunities for educators and students throughout the state of Illinois and beyond

IMSA's Core Competencies

Integrative learning experiences are those which forge meaningful connections of concepts, constructs, and principles within and across academic subjects and real-world situations

application, and construction of meaning through mindful investigation driven by compelling questions that have engaged, or have the potential for engaging, the learner's curiosity

learners grapple with complex, meaningful and open-ended problems, and work toward their resolution

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Problem Centered learning experiences are those in which learners grapple with complex, meaningful, open-ended, and problems, and work toward their resolution

History of PCL/PBL

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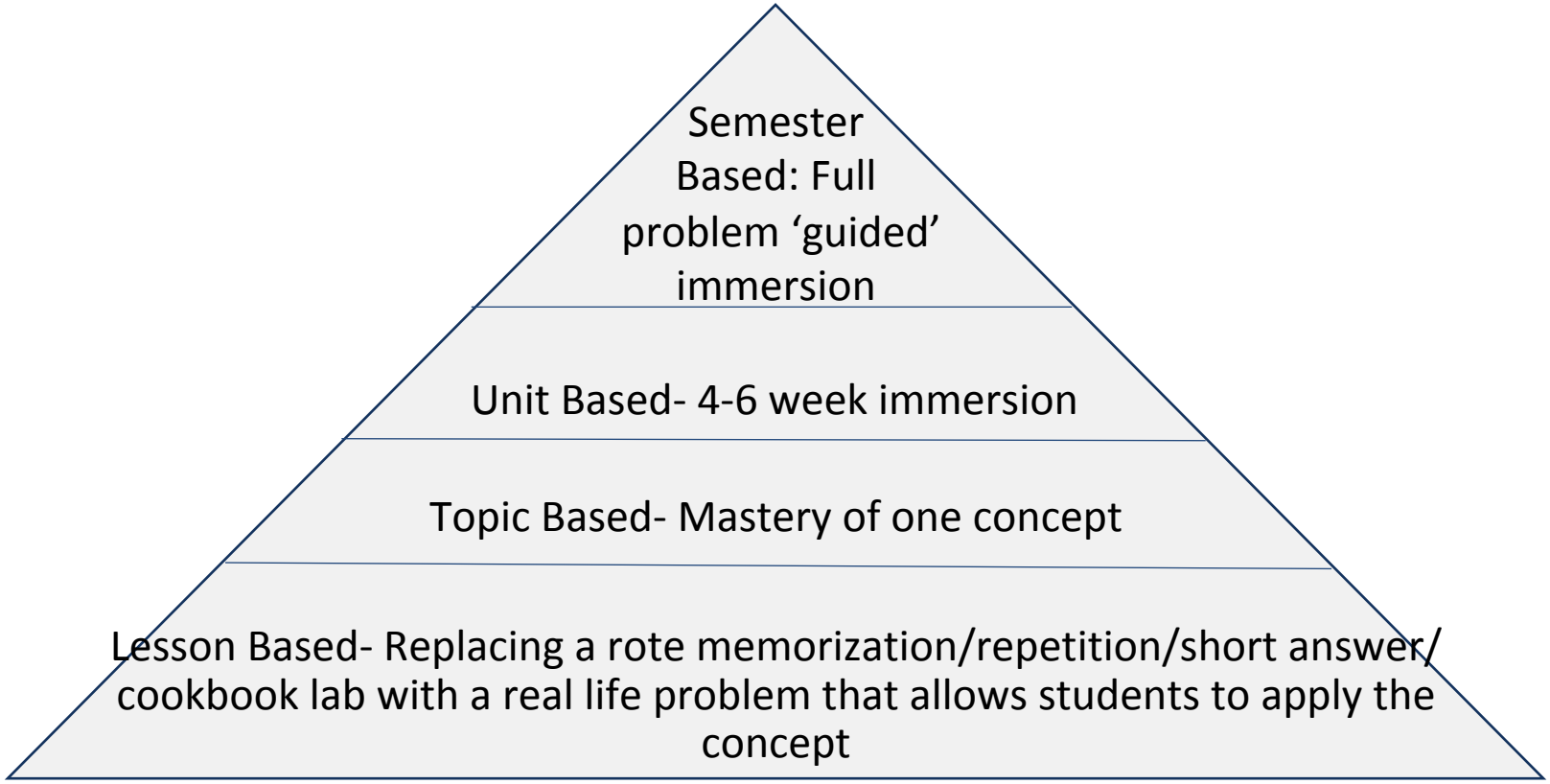
What are some of the barriers to Problem Centered/ Problem Based Learning the way it has been historically used?

Overall Goals and Student Benefits to PCL

- Presents material in a realistic, applicable way
- Encourages students to take charge of their own learning
- Takes advantage of students' natural curiosity
- Encourages 'learning how to learn'

Tiered Levels of PCL



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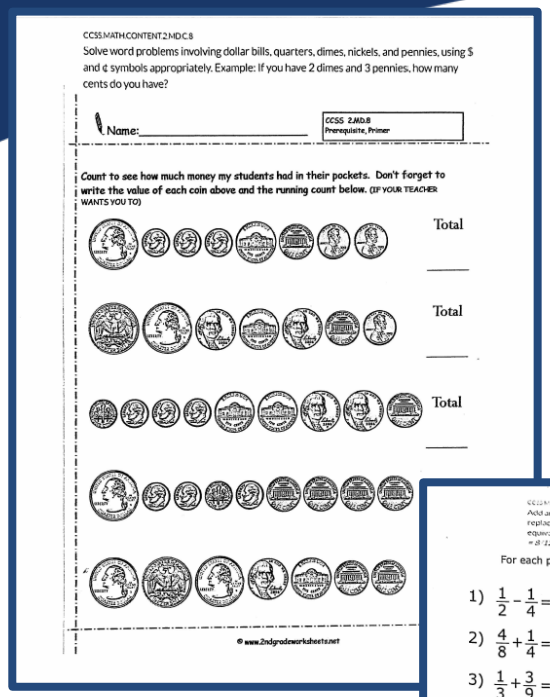
2nd Grade



CCSS.MATH.CONTENT.2.MD.C.8

Solve word problems involving dollar bills, quarters, dimes, nickels, and pennies, using $ and ¢ symbols appropriately. Example: If you have 2 dimes and 3 pennies, how many cents do you have?

Name:_____ CCSS 2.MD.8 Prerequisite, Primer

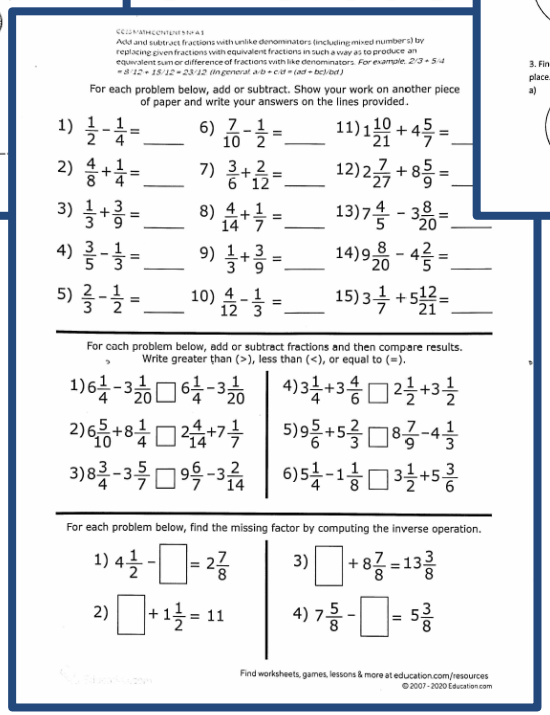
Count to see how much money my students had in their pockets. Don't forget to write the value of each coin above and the running count below. (IF YOUR TEACHER WANTS YOU TO)

Total _____

Total _____

Total _____

5th Grade



CCSS.MATH.CONTENT.5.NF.A.1

Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. *For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd.)*

For each problem below, add or subtract. Show your work on another piece of paper and write your answers on the lines provided.

1) $\frac{1}{2}-\frac{1}{4}=$ ____ 6) $\frac{7}{10}-\frac{1}{2}=$ ____ 11) $1\frac{10}{21}+4\frac{5}{7}=$ ____

2) $\frac{4}{8}+\frac{1}{4}=$ ____ 7) $\frac{3}{6}+\frac{2}{12}=$ ____ 12) $2\frac{7}{27}+8\frac{5}{9}=$ ____

3) $\frac{1}{3}+\frac{3}{9}=$ ____ 8) $\frac{4}{14}+\frac{1}{7}=$ ____ 13) $7\frac{4}{5}-3\frac{8}{20}=$ ____

4) $\frac{3}{5}-\frac{1}{3}=$ ____ 9) $\frac{1}{3}+\frac{3}{9}=$ ____ 14) $9\frac{8}{20}-4\frac{2}{5}=$ ____

5) $\frac{2}{3}-\frac{1}{2}=$ ____ 10) $\frac{4}{12}-\frac{1}{3}=$ ____ 15) $3\frac{1}{7}+5\frac{12}{21}=$ ____

For each problem below, add or subtract fractions and then compare results. Write greater than (>), less than (<), or equal to (=).

1) $6\frac{1}{4}-3\frac{1}{20}\square 6\frac{1}{4}-3\frac{1}{20}$

2) $6\frac{5}{10}+8\frac{1}{4}\square 2\frac{4}{14}+7\frac{1}{7}$

3) $8\frac{3}{4}-3\frac{5}{7}\square 9\frac{6}{7}-3\frac{2}{14}$

4) $3\frac{1}{4}+3\frac{4}{6}\square 2\frac{1}{2}+3\frac{1}{2}$

5) $9\frac{5}{6}+5\frac{2}{3}\square 8\frac{7}{9}-4\frac{1}{3}$

6) $5\frac{1}{4}-1\frac{1}{8}\square 3\frac{1}{2}+5\frac{3}{6}$

For each problem below, find the missing factor by computing the inverse operation.

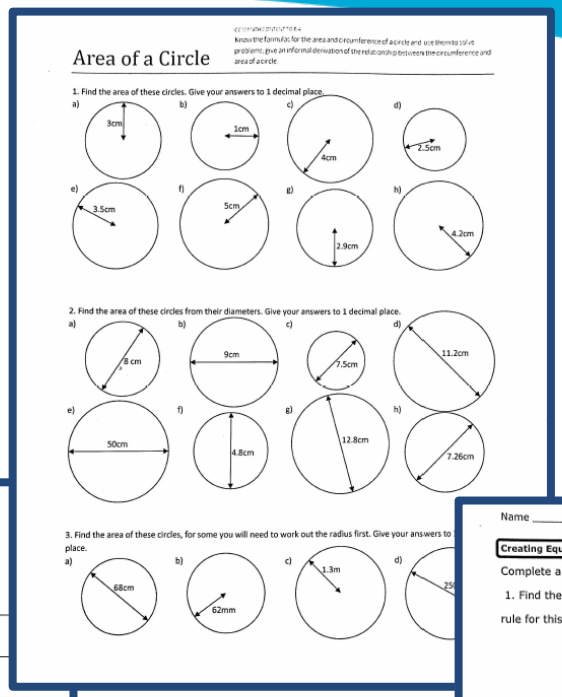
1) $4\frac{1}{2}-\square=2\frac{7}{8}$

2) $\square+1\frac{1}{2}=11$

3) $\square+8\frac{7}{8}=13\frac{3}{8}$

4) $7\frac{5}{8}-\square=5\frac{3}{8}$

7th Grade



Area of a Circle

Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle

1. Find the area of these circles. Give your answers to 1 decimal place.

a) 3cm b) 1cm c) 4cm d) 2.5cm

e) 3.5cm f) 5cm g) 2.9cm h) 4.2cm

2. Find the area of these circles from their diameters. Give your answers to 1 decimal place.

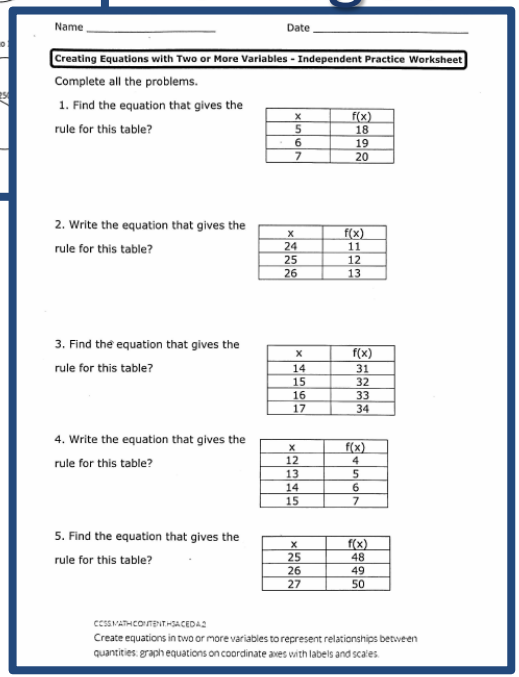
a) 8 cm b) 9cm c) 7.5cm d) 11.2cm

e) 50cm f) 4.8cm g) 12.8cm h) 7.26cm

3. Find the area of these circles, for some you will need to work out the radius first. Give your answers to 1 decimal place.

a) 68cm b) 62mm c) 1.3m d)

HS- Algebra



Name _____ Date _____

Creating Equations with Two or More Variables - Independent Practice Worksheet

Complete all the problems.

1. Find the equation that gives the rule for this table?

x	f(x)
5	18
6	19
7	20

2. Write the equation that gives the rule for this table?

x	f(x)
24	11
25	12
26	13

3. Find the equation that gives the rule for this table?

x	f(x)
14	31
15	32
16	33
17	34

4. Write the equation that gives the rule for this table?

x	f(x)
12	4
13	5
14	6
15	7

5. Find the equation that gives the rule for this table?

x	f(x)
25	48
26	49
27	50

CCSS.MATH.CONTENT.HSA.CED.A.2

Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

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1. Make the Content **Relatable**

“When are we ever going to use this??”

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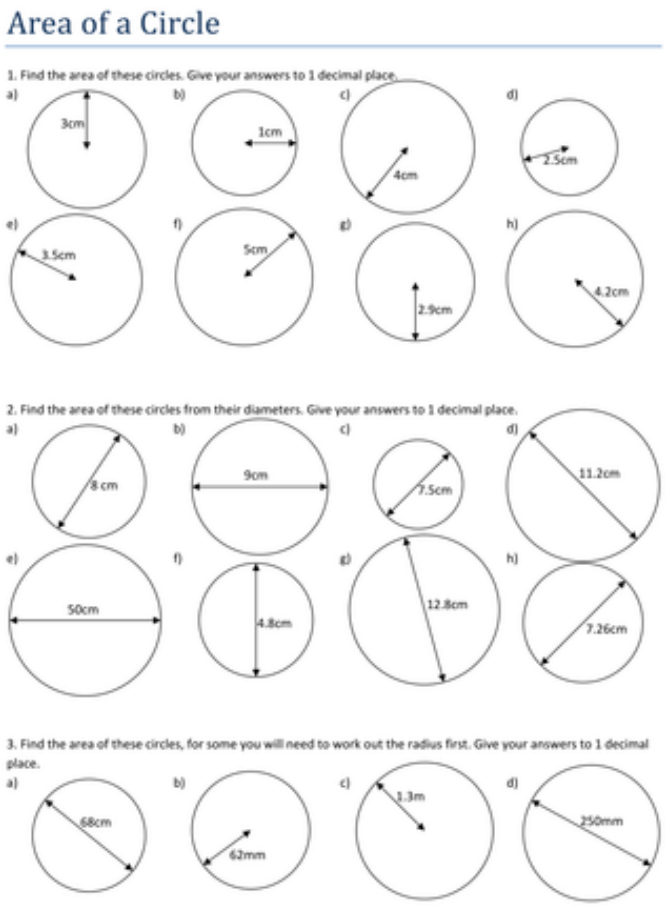
Find the area of a circle



Area of a Circle

1. Find the area of these circles. Give your answers to 1 decimal place.

a) 3cm b) 1cm c) 4cm d) 2.5cm

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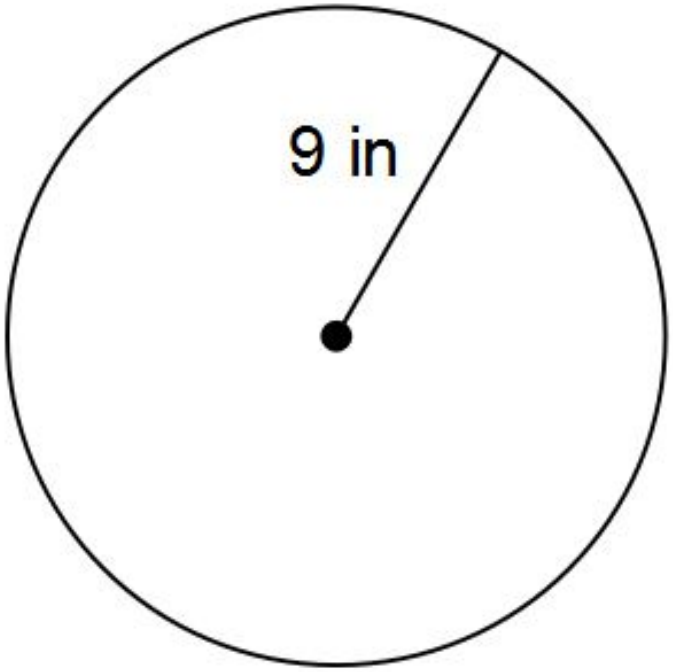
a) 8 cm b) 9cm c) 7.5cm d) 11.2cm

e) 50cm f) 4.8cm g) 12.8cm h) 7.26cm

3. Find the area of these circles, for some you will need to work out the radius first. Give your answers to 1 decimal place.

a) 68cm b) 62mm c) 1.3m d) 250mm



Find the area of a PIZZA

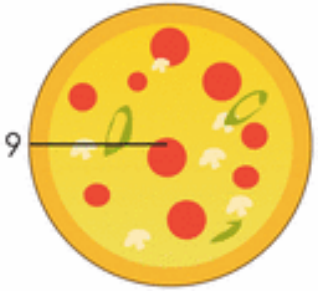
PIZZA CIRCLES
Area, Circumference, Diameters

Fill in the missing information about these pizzas!

Formulas:

Diameter = 2(radius) Circumference=π(diameter) Area=πr^2

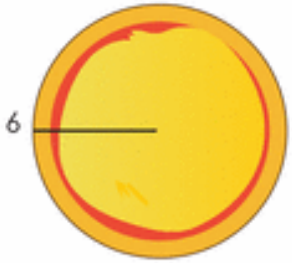
For this assignment please use π=3.14



diameter: _____

circumference: _____

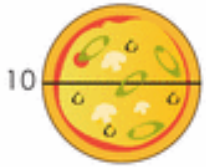
area: _____



diameter: _____

circumference: _____

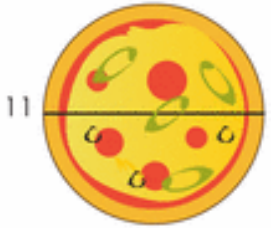
area: _____



radius: _____

circumference: _____

area: _____



radius: _____

circumference: _____

area: _____

More worksheets at www.education.com/worksheets

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PIZZA PARTY!!!

Our class is having a pizza party to celebrate _____. Principal/Teacher/Parents offered to pay for the pizza, but only if we can guarantee they're getting the best deal. It is up to you to contact local pizza places to get prices and sizes, and determine which pizza place gets you the most pizza for your $$$.

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2. Structure: Less is More

Let the students guide the process

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prob·lem

/ˈpräbləm/

noun

noun: **problem**; plural noun: **problems**

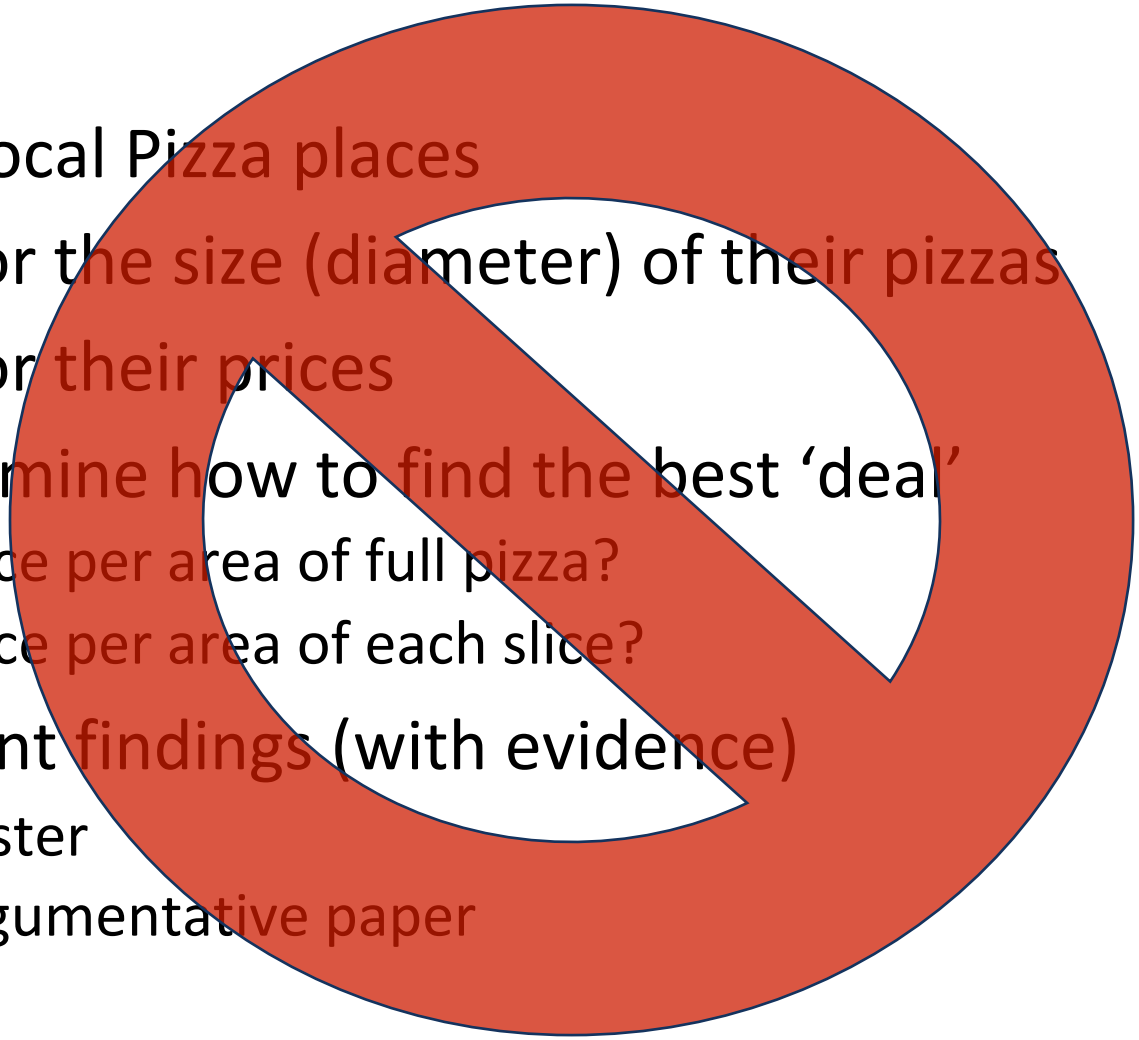
1. a matter or situation regarded as unwelcome or harmful and needing to be dealt with and overcome.
   "they have financial problems"

   Similar: difficulty | issue | trouble | worry | complication

   - a thing that is difficult to achieve or accomplish.
     "motivation of staff can also be a problem"
   - denoting or relating to people whose behavior causes difficulties to themselves and others.
     "practitioners help families develop strategies for managing problem behavior in teens"

Pizza Party Problem

- Call Local Pizza places
- Ask for the size (diameter) of their pizzas
- Ask for their prices
- Determine how to find the best ‘deal’
  - Price per area of full pizza?
  - Price per area of each slice?
- Present findings (with evidence)
  - Poster
  - Argumentative paper



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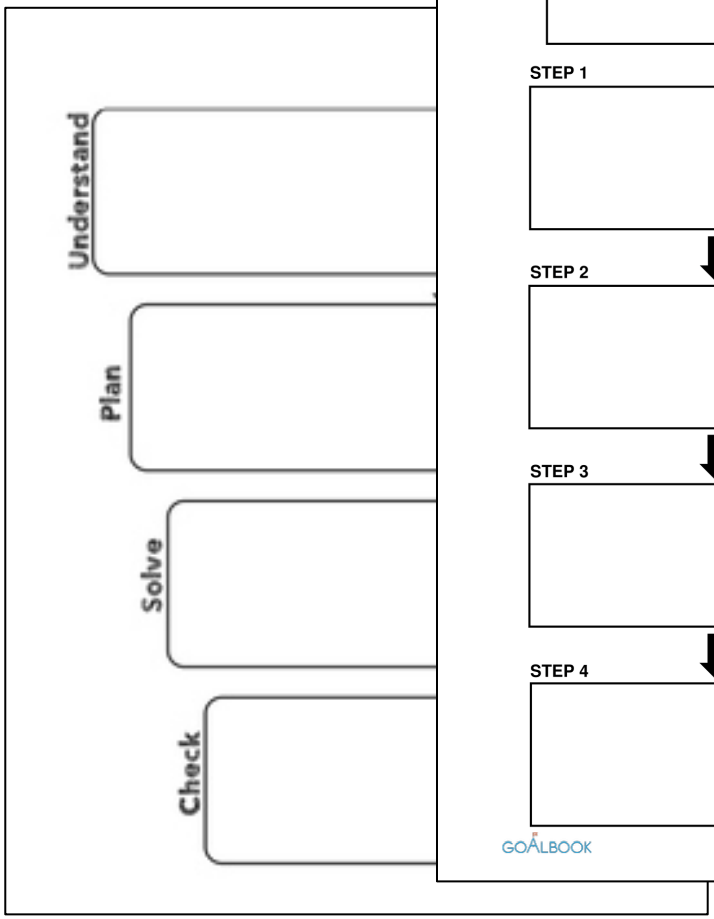

Annotated Example Problem Template: Step-by-Step Guide

Topic _____

PROBLEM

STEP 1

STEP 2

STEP 3

STEP 4

GOALBOOK

Find more resources at https://goalbookapp.com

3. Be a Resource, not their Answer Key

Never give a student a direct answer

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Before you answer a question:

- Could they find it in their notes?
- Could they find it in a textbook?
- Have they asked a neighbor?
- Is it something they could research online?
- Could they find a video on the topic?
- Have they made any attempts?
- Have they read the directions thoroughly?
- Could you brainstorm ideas?
- Have they listed what they already know about the topic?
- Have you given them a hint?

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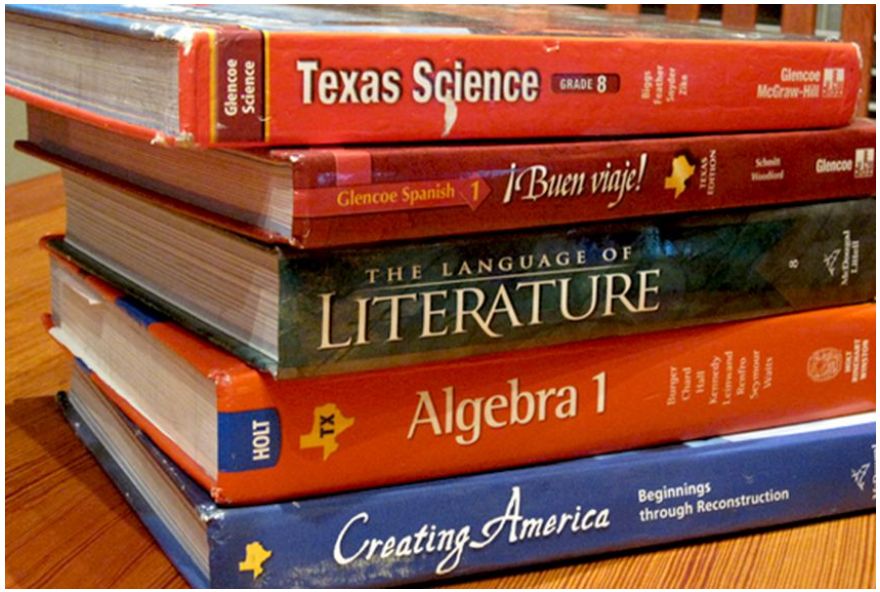

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“What do *YOU* think??”

4. If Possible, use a problem to *Introduce* a topic

Once students are comfortable with Problem-Centered Learning, use problems to introduce a topic rather than assess it

PIZZA PARTY!!!

Our class is having a pizza party to ce
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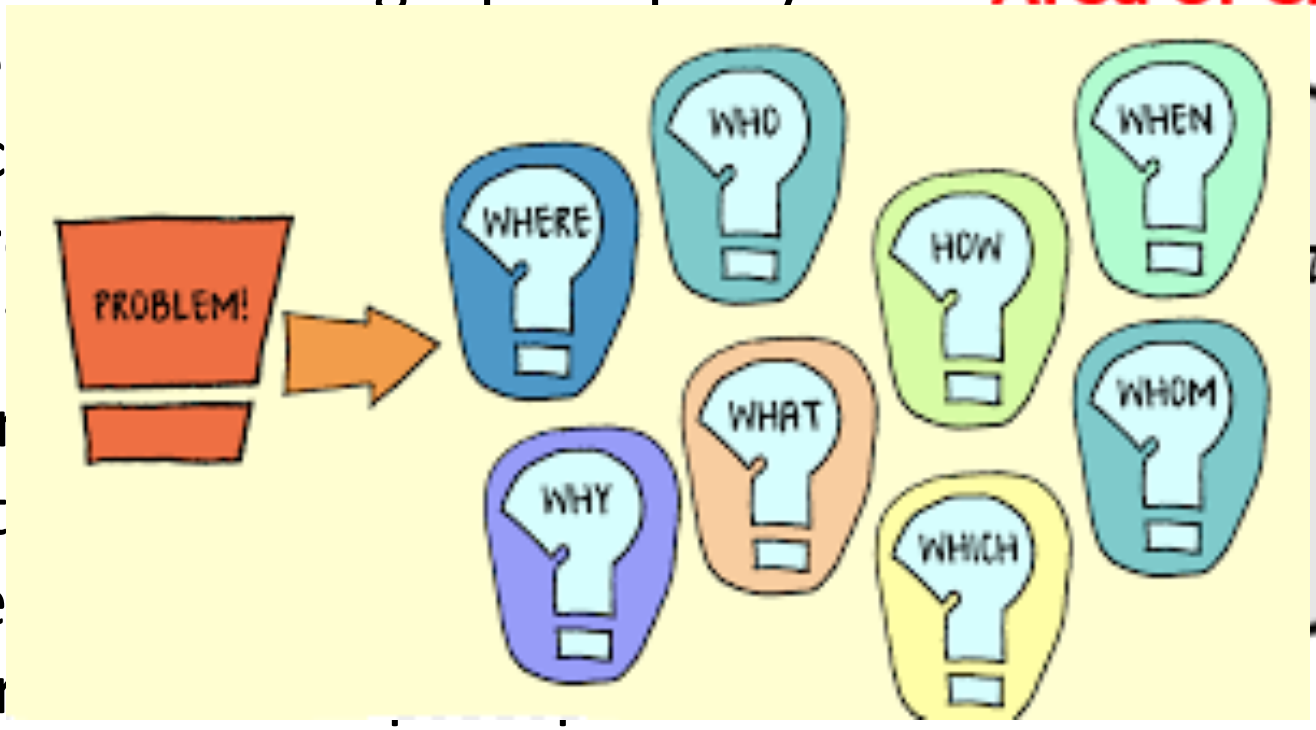
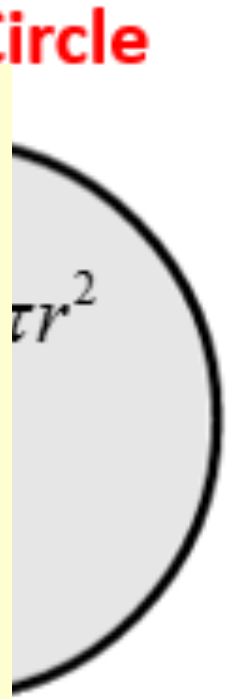
offer
only
getti
you t
to ge
deter
gets you the most pizza for your $$$.





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Overall Goals and Student Benefits to PCL

- Presents material in a realistic, applicable way
- Encourages students to take charge of their own learning
- Takes advantage of students' natural curiosity
- Encourages 'learning how to learn'

Presents material in a realistic, applicable way

1b: Demonstrating Knowledge of Students	The teacher displays minimal understanding of how students learn—and little knowledge of their varied approaches to learning, knowledge and skills, special needs, and interests and cultural heritages—and does not indicate that such knowledge is valuable.	The teacher displays generally accurate knowledge of how students learn and of their varied approaches to learning, knowledge and skills, special needs, and interests and cultural heritages, yet may apply this knowledge not to individual students but to the class as a whole.	The teacher understands the active nature of student learning and attains information about levels of development for groups of students. The teacher also purposefully acquires knowledge from several sources about groups of students' varied approaches to learning, knowledge and skills, special needs, and interests and cultural heritages.	The teacher understands the active nature of student learning and acquires information about levels of development for individual students. The teacher also systematically acquires knowledge from several sources about individual students' varied approaches to learning, knowledge and skills, special needs, and interests and cultural heritages.

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https://www.ode.state.or.us/wma/teachlearn/commoncore/danielson-2013-rubric-only.pdf

Encourages students to take charge of their own learning

3c: Engaging Students in Learning	The learning tasks/ activities, materials and, resources are poorly aligned with the instructional outcomes, or require only rote responses, with only one approach possible. The groupings of students are unsuitable to the activities. The lesson has no clearly defined structure, or the pace of the lesson is too slow or rushed.	The learning tasks and activities are partially aligned with the instructional outcomes but require only minimal thinking by students and little opportunity for them to explain their thinking, allowing most students to be passive or merely compliant. The groupings of students are moderately suitable to the activities. The lesson has a recognizable structure; however, the pacing of the lesson may not provide students the time needed to be intellectually engaged or may be so slow that many students have a considerable amount of "down time."	The learning tasks and activities are fully aligned with the instructional outcomes and are designed to challenge student thinking, inviting students to make their thinking visible. This technique results in active intellectual engagement by most students with important and challenging content and with teacher scaffolding to support that engagement. The groupings of students are suitable to the activities. The lesson has a clearly defined structure, and the pacing of the lesson is appropriate, providing most students the time needed to be intellectually engaged.	Virtually all students are intellectually engaged in challenging content through well-designed learning tasks and activities that require complex thinking by students. The teacher provides suitable scaffolding and challenges students to explain their thinking. There is evidence of some student initiation of inquiry and student contributions to the exploration of important content; students may serve as resources for one another. The lesson has a clearly defined structure, and the pacing of the lesson provides students the time needed not only to intellectually engage with and reflect upon their learning but also to consolidate their understanding.

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Takes advantage of students' natural curiosity

2b: Establishing a Culture for Learning	The classroom culture is characterized by a lack of teacher or student commitment to learning, and/or little or no investment of student energy in the task at hand. Hard work and the precise use of language are not expected or valued. Medium to low expectations for student achievement are the norm, with high expectations for learning reserved for only one or two students.	The classroom culture is characterized by little commitment to learning by the teacher or students. The teacher appears to be only "going through the motions," and students indicate that they are interested in the completion of a task rather than the quality of the work. The teacher conveys that student success is the result of natural ability rather than hard work, and refers only in passing to the precise use of language. High expectations for learning are reserved for those students thought to have a natural aptitude for the subject.	The classroom culture is a place where learning is valued by all; high expectations for both learning and hard work are the norm for most students. Students understand their role as learners and consistently expend effort to learn. Classroom interactions support learning, hard work, and the precise use of language.	The classroom culture is a cognitively busy place, characterized by a shared belief in the importance of learning. The teacher conveys high expectations for learning for all students and insists on hard work; students assume responsibility for high quality by initiating improvements, making revisions, adding detail, and/or assisting peers in their precise use of language.

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Encourages ‘learning how to learn’

3b: Using Questioning and Discussion Techniques	The teacher's questions are of low cognitive challenge, with single correct responses, and are asked in rapid succession. Interaction between the teacher and students is predominantly recitation style, with the teacher mediating all questions and answers; the teacher accepts all contributions without asking students to explain their reasoning. Only a few students participate in the discussion.	The teacher's questions lead students through a single path of inquiry, with answers seemingly determined in advance. Alternatively, the teacher attempts to ask some questions designed to engage students in thinking, but only a few students are involved. The teacher attempts to engage all students in the discussion, to encourage them to respond to one another, and to explain their thinking, with uneven results.	While the teacher may use some low-level questions, he poses questions designed to promote student thinking and understanding. The teacher creates a genuine discussion among students, providing adequate time for students to respond and stepping aside when doing so is appropriate. The teacher challenges students to justify their thinking and successfully engages most students in the discussion, employing a range of strategies to ensure that most students are heard.	The teacher uses a variety or series of questions or prompts to challenge students cognitively, advance high-level thinking and discourse, and promote metacognition. Students formulate many questions, initiate topics, challenge one another's thinking, and make unsolicited contributions. Students themselves ensure that all voices are heard in the discussion.

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